

In the name of Allah, the Most Gracious, the Most Merciful



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$$1/ n = 1,5 \quad d = 6000 \text{ \AA}$$

$$p = \frac{E}{c} \quad E = \frac{hc}{d} \quad p = \frac{hc/d}{c} \quad p = \frac{h}{d}$$

$$p = \frac{6,62 \cdot 10^{-34}}{6000 \cdot 10^{-10}}$$

$$p = 1,103 \cdot 10^{-27} \text{ SI} \\ p = 11,03 \cdot 10^{-28} \text{ SI}$$

$$2/ E = \frac{hc}{d} \quad E = \frac{12400 (\text{eV \AA})}{d (\text{\AA})} \quad E = \frac{12400}{6000} \quad E = 2,06 \text{ eV} \\ E = 2,06 \text{ eV}$$

$$3/ E = h\nu \quad E = \frac{hc}{d} \rightarrow \nu = \frac{c}{d} \quad \nu = \frac{3 \cdot 10^8}{6000 \cdot 10^{-10}}$$

$$\nu = 0,5 \cdot 10^{15} \text{ Hz} \quad \nu = 5 \cdot 10^{14} \text{ Hz}$$

$$4/ c = 3 \cdot 10^8 \text{ m/s} \quad \nu = \frac{c}{\lambda} \quad \nu = \frac{3 \cdot 10^8}{1,5} \quad \nu = 2 \cdot 10^8 \text{ m/s}$$

$$5/ E_{CA} = 100 \text{ keV} \quad E_{CA} = eU \rightarrow U = \frac{E_{CA}}{e} \quad U = \frac{100 \text{ keV}}{e} \\ U = 100 \text{ kV}$$

$$6/ \phi = \frac{1}{2} [0,5 (100 - 80)] \quad \phi = 20 \text{ W}$$

$$7/ f = \frac{\phi}{UI} \rightarrow I = \frac{\phi}{fU} \quad I = \frac{20}{0,5 \cdot 10^{-2} \cdot 100 \cdot 10^3}$$

$$I = 40 \cdot 10^{-3} \text{ A} \quad I = 40 \text{ mA}$$

$$8/ E_{CA} = eU \quad E_{CA} = 100 \text{ keV} \quad \frac{E_{CA}}{E_0} = \frac{100}{511} = 0,1957 \quad \frac{1}{200} \\ \rightarrow e^- \text{ relativiste}$$

$$E = \frac{E_0}{\sqrt{1 - \beta^2}} \rightarrow \beta = \sqrt{1 - \left(\frac{E_0}{E}\right)^2}$$

$$E = E_0 + E_{CA} \quad E = 511 + 100 \quad E = 611 \text{ keV}$$

$$\rightarrow \beta = 0,548 \rightarrow v = \beta c \quad v = 1,64 \cdot 10^8 \text{ m/s}$$

9/ Rep (C)

10/ même nombre de protons et même nombre de neutrons \rightarrow Rep (A) - 1

11/ L'énergie maximale des rayons

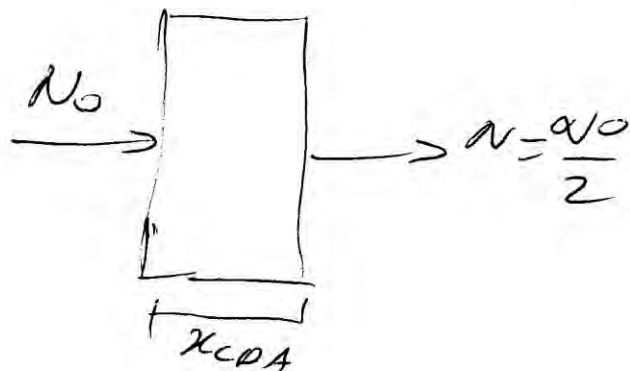
$$E_{\max} = eV \quad E_{\max} = 80 \text{ keV}$$

12/ $E_a = 3E_{01}$ $E_n = E_{01} + E_{02}$ $E_n = 4E_{01}$

$$E_n = \frac{E_{01}}{\sqrt{1-\beta^2}} \quad \beta = \sqrt{1 - \left(\frac{E_{01}}{4E_{01}}\right)^2}$$

$$\beta = 0,968 \rightarrow v = \beta c \rightarrow v = 2,940^8 \text{ m/s}$$

13/ Rep (C)
= 50%



14/ Rep (B)

15/ Rep (C)

16/ Rep (B)

17/ Rep (C)

18/ Comptant $\rightarrow E \geq 13,6 \text{ eV}$

a/ $E = h\nu$ $E = \frac{6,62 \cdot 10^{-34}}{1,6 \cdot 10^{-19}} \quad E = 12,4 \cdot 10^5 \text{ eV} > 13,6 \text{ eV}$
 \rightarrow comptant

b/ $n=2$ $d_m = 0,4 \mu\text{m}$ $\frac{d}{d_m} = n$ $d = 2d_m$
 $d = 0,8 \mu\text{m}$

$E = \frac{12400}{0,8 \cdot 10^{-6} \cdot 10^{10}} \quad E = 1,55 < 13,6 \text{ non comptant}$
- 2 -

$$c/ E = h\nu \quad E = \frac{h}{T} \quad \text{car } \nu = \frac{1}{T}$$

$$E = \frac{6,62 \cdot 10^{-34}}{10^{-5} \times 1,6 \cdot 10^{-19}}$$

$$E = 4,13 \cdot 10^{-10} \text{ eV non ionisant}$$

$$19/ \lambda = 0,4 \text{ nm dans le vide}$$

$$E = \frac{12400}{0,4 \cdot 10^{-9} \times 10^{10}} \quad E = 3,1 \text{ eV}$$

$$20/ \nu = \frac{1}{T} \quad \text{paramètre - temps ne varie pas}$$

$$21/ E_T = 950 \text{ MeV} \quad E_{0P} = 938 \text{ MeV}$$

$$\frac{E_{0P}}{E_T} = \frac{938}{950} \quad \frac{E_{0P}}{E_T} = 0,98 > \frac{1}{400} \rightarrow \text{relativiste}$$

$$E_T = \frac{E_{0P}}{\sqrt{1-\beta^2}} \rightarrow (1-\beta^2) = \left(\frac{E_{0P}}{E_T} \right)^2$$

$$\beta = \left[1 - \left(\frac{E_{0P}}{E_T} \right)^2 \right]^{1/2} \rightarrow \beta = 0,158$$

$$\beta = \frac{v}{c} \rightarrow v = \beta \cdot c \quad v = 0,158 \times 3 \cdot 10^8$$

$$v = 0,475 \cdot 10^8 \text{ m/s}$$

$$22/ E_T = 591 \text{ keV} \quad E_T = E_0 + E_{CA} \quad E_0 = 0,511 \text{ MeV}$$

$$E_{CA} = E_T - E_0 \quad E_{CA} = 591 - 511$$

$$E_{CA} = 80 \text{ keV}$$

$$23/ E_{CA} = 80 \text{ keV} > W_K > W_L \dots$$

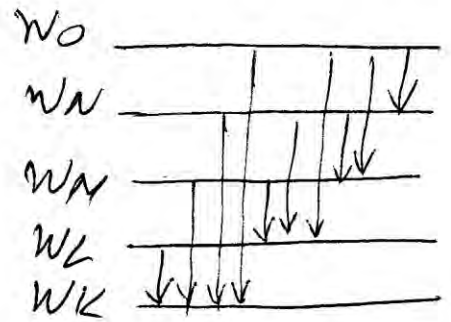
donc tous les niveaux participent aux transitions électroniques

l'énergie max des raies

$$W_K E = W_K - W_0$$

$$E = 69,52 - 0,05$$

$$E = 69,47 \text{ keV}$$



$$24/ E = h\nu \quad E = \frac{h}{T} \quad E = \frac{6,62 \cdot 10^{-34}}{3,33 \cdot 10^{-14}} \quad E = 1,987 \cdot 10^{-15} \text{ J}$$

$$E = \frac{1,987 \cdot 10^{-15}}{1,6 \cdot 10^{-19}}$$

$$E = 1,241 \cdot 10^4 \text{ eV} \quad E = 12,41 \text{ keV}$$

$$25/ E = \frac{hc}{\lambda} \quad \lambda = \frac{hc}{E} \quad \lambda = \frac{12400}{12,4 \cdot 10^3} \quad \lambda = 10^{-9} \text{ m}$$

$$\frac{\lambda}{\lambda_m} = 2 \rightarrow \lambda_n = \frac{\lambda}{2} \quad \lambda_m = \frac{1}{2,5} \quad \lambda_n = 0,4 \text{ Å}$$

$$26/ P = \frac{E}{c} \quad P = \frac{1,987 \cdot 10^{-15}}{3 \cdot 10^8} \quad P = 6,62 \cdot 10^{-24} \frac{\text{J}}{\text{m}}$$

$$27/ E_{CA} = 12,41 \text{ keV}$$

$$E_{CA} = eV \rightarrow U = \frac{E_{CA}}{e} \rightarrow U = 12,41 \text{ kV}$$

$$28/ \lambda = \frac{h}{p} \quad p = mv \quad p = m\beta c \times \frac{c}{c}$$

$$p = \beta \frac{E}{c} \rightarrow \lambda = \frac{h}{\beta \frac{E}{c}} \quad \lambda = \frac{hc}{\beta E} \quad \text{mr, sorte}$$

$$29 \quad P = \frac{E}{c} \quad P = \frac{h\nu}{c} \quad P = \frac{6,62 \cdot 10^{-34} \cdot 3 \cdot 10^{18}}{3 \cdot 10^8}$$

$$P = 6,62 \cdot 10^{-24} \text{ SI}$$

30/ L'énergie ne dépend pas du milieu

$$E = h\nu \quad E = \frac{6,62 \cdot 10^{-34} \cdot 3 \cdot 10^{18}}{1,6 \cdot 10^{-19}}$$

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$$31/ \quad E_T = mc^2 \quad E_T = E_0 + E_{cA}$$

$$\text{avec } E_{cA} = E = 12,41 \text{ keV} \rightarrow E_T = 12,41 + 511$$

$$E_T = 563,41 \text{ keV}$$

$$m = \frac{E}{c^2} \quad m = \frac{(563,41 \times 10^3 \times 1,6 \times 10^{-19})}{(3 \cdot 10^8)^2} \quad m = 9,31 \cdot 10^{-31} \text{ kg}$$

$$32/ \quad E_{cA} = \cancel{563,41 \cdot 10^{-31}} \text{ kg}$$

$$E_{cA} = 12,41 \text{ keV}$$

33/ même vitesse \rightarrow donc même β .

$$E = \frac{E_0}{\sqrt{1-\beta^2}} \quad (1) \quad E = E_0 + E_c \rightarrow E_c = E - E_0$$

$$E_c = \frac{E_0}{\sqrt{1-\beta^2}} - E_0 \quad E_c = E_0 \left[\frac{1}{\sqrt{1-\beta^2}} - 1 \right]$$

$$E_c = E_0 \left[\frac{1}{\sqrt{1-\beta^2}} - 1 \right] \quad (2)$$

- selon (2) E_c proton est supérieure à E_c de l'électron car $E_{0p} > E_{0e}$
- $E_{0p} > E_{0e}$ et $E_{cp} > E_{ce}$
 $E = E_c + E_0$ donc l'énergie totale de proton est supérieure à celle de l'électron.
- ou l'énergie cinétique du proton est supérieure à celle de l'électron car E_{0p} est supérieure à E_{0e} \rightarrow donc Rep (2)

$$34/ \quad E_{Tp} = E_{Te} \quad \text{ou} \quad E_T = E_0 + E_c$$

- $E_{0p} > E_{0e} \rightarrow$ donc il n'est pas la même
- non il n'est pas la même vitesse car $E_c \neq E_0$
- $E_T = E_0 + E_c \quad E_{0p} > E_{0e} \Rightarrow E_{ce} > E_{cp}$
 donc l'électron a une plus grande vitesse

Suite ex 28

$$E = E_0 + E_c \quad E = 511 + 12,41 \quad E = 523,41 \text{ eV}$$

Calcul de β

$$E = \frac{E_0}{\sqrt{1-\beta^2}} \rightarrow (1-\beta^2) = \left(\frac{E_0}{E}\right)^2$$

$$\beta = \sqrt{1 - \left(\frac{E_0}{E_T}\right)^2} \quad \beta = \sqrt{1 - \left(\frac{511}{523,41}\right)^2}$$

$$\beta = 0,216$$

$$\lambda = \frac{hc}{\beta E} \quad \lambda = \frac{12400 \text{ eV}\cdot\text{\AA}}{0,216 \times 523,41 \times 10^3 \text{ eV}} \quad \lambda = 0,11 \text{\AA}$$

$$\lambda = 20,109 \times 10^{-3} \text{\AA}$$

$$\lambda = 20,109 \text{\AA}$$